CORNELL 4-H CLUB BULLETIN 80

Grow Good POTATOES

Arthur J. Pratt

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What Makes a Potato Project Good?

Most things that make the crop big make potatoes good. The following are "musts" in a first-rate potato project:

1. Disease-free seed, preferably of a blight-resistant variety
2. Plenty of seed—from 25 to 30 bushels to the acre
3. Seed that has short, thick, green sprouts at planting time
4. Good soil with an acidity of about pH 5.0
5. Plenty of fertilizer—at least 1 ton to the acre of 5–10–10 or 1250 pounds of 8–16–16
6. Half of the fertilizer plowed under and the other half put in bands near the row
7. Good weed control
8. Thorough insect control with DDT
9. Care in digging and handling the potatoes

To 4-H Club Local Leaders

The questions at the end of each section of this bulletin will help you in teaching potato growing at club meetings. Some leaders first read the questions to the club, then have the members take turns reading that section of the bulletin covered by the questions. After that, the club is divided into two teams and the leader reads the questions while each member writes the answers. Papers are exchanged between the club members and corrected. The scores of the members of each team are added to see which team has the highest total score.

Many of the liveliest 4-H Clubs supplement the regular meetings with extra club activities that build interest and provide broadening experiences, such as: cooperative purchase of seed, insecticides, and market packages; potato-project contests within the club; local club tours and county tours to good potato farms; participation in local, county, state, and national potato and vegetable judging, grading, and demonstration contests and exhibits.

Grow Good Potatoes

By ARTHUR J. PRATT

Why

Usually there is money in growing potatoes for sale if yields are high. Where potatoes are not grown on a large scale, it often pays to grow at least enough for home use and some for sale to nearby customers.

Who

Anyone from 10 to 21 years of age may have a potato project if he can get a suitable piece of land and thinks he might be interested in potato growing. Anyone may enroll as an individual 4-H member with the county 4-H agent if there is no nearby 4-H Club to join.

Size

The size of the project depends on the land and tools available as well as on your ability. There are no exact size limits. Good 4-H potato projects have varied from plots of less than 1000 square feet to fields of several acres. Not all large projects have been good. The yield from a definite area is the most important thing that makes potato growing pay. If you are still in school, it might be well to plan a project that would take an average of not less than 1 nor more than 5 hours of work a week. If potatoes are grown for sale on your farm, it is usually best to have your 4-H project in the same field with the main crop.

Tools

The tools needed depend on the size of the project. Potato growing is becoming a highly specialized industry. To compete on most markets you must get high yields and keep your hours of labor, as well as those of hired help, as low as possible. This can be done by using a tractor, a 2-row picker planter, a weeder, a 2-row cultivator, a power sprayer or duster, and a power-take-off digger. In areas where few potatoes are grown for sale, however, a good profit can usually be made from a high-yielding

Author's acknowledgment. 4-H Club Agents Laurence Dedrick and Robert Blatchley gave many helpful suggestions in the preparation of this bulletin.

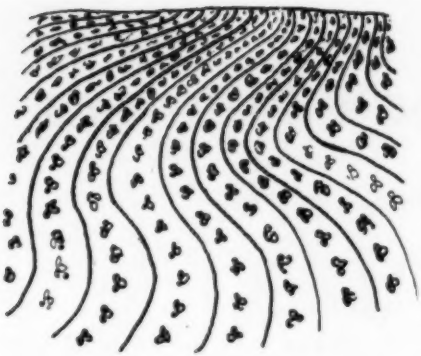

Figure 1. Plant on the contour, not up and down hill, to prevent erosion,—the washing away of soil

crop grown on a very small area even tho it is cared for with simple tools.

Soil

A deep, well-drained, loamy soil is best for potatoes. In it potatoes are brighter, better shaped, and better quality than those grown in clay or clay loom. A good loam usually produces a bigger crop than does a very light sand because it holds moisture and fertilizer better. Any soil that has been badly eroded is not likely to produce a good crop.

Rotation

Rotation is the growing of one crop after another on the same land and in a definite order. If potatoes are rotated with grass crops in regions where wireworm or white-grub injury is common, the ground should be treated with chlordane or heptachlor. The reason for this is clear if you study the life stories of these two insects (page 18). Also, it may not be wise to rotate potatoes with crops that need a high-lime soil, such as cabbage and cauliflower, for potatoes are likely to be scabby when grown on such soil (page 7).

It is best, therefore, to follow one of these cropping systems:

1. Grow potatoes on the same field each year. Use a variety that matures early; or, if the vines are not dead by late September, kill them with a vine-killing spray or rotary beater so the potatoes can be dug by early October and the field seeded at once to a rye cover crop. Or:

2. Grow potatoes on the same field each year. Use a late variety, but seed rye between the rows during early September so there will be at

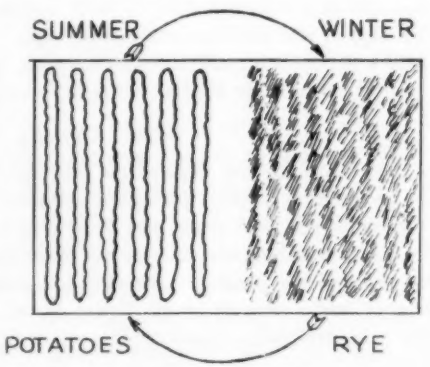

Figure 2. This is rotation 1. Rye follows potatoes

least a partial winter cover on the land. Or:

3. Plan a special rotation that will maintain or build up the soil fertility of your field and one that will produce a crop free from the disease and insect injuries that can be prevented by special cropping systems.

With good care, plenty of fertilizer, good erosion control, and the use of soil-improving crops, some fields have produced good crops of potatoes every year for more than 50 years.

Soil Acidity and Scab Prevention

The best soil-acidity range for potatoes is between pH 4.8 to 5.4 Potatoes grown in a soil that has a pH of 5.5 to 7+ usually are scabby. Those grown in either more alkaline or more acid soil may not be scabby but the yield will be less.

Scab is one of the major causes of cull potatoes, yet a 5-minute soil test by your county 4-H agent will show whether or not scab-free potatoes can be grown on your plot of land. The symbol pH is used to express soil acidity. If the soil acidity is not right, use a scab-resistant variety such as Ontario or correct the acidity before you plant. Sulfur and acid-forming fertilizers make the soil more acid. Lime, alkaline fertilizers, and fresh manure make the soil more alkaline.

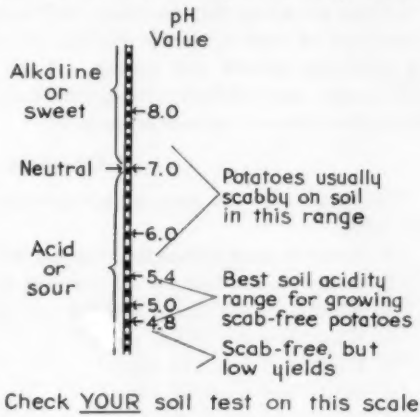

Figure 3. Ask your 4-H Club agent to test the soil acidity

Questions

1. Is there money in growing potatoes for sale?
2. How large an area is needed to make a good 4-H potato project?
3. Should you grow your potatoes in the same field with your father's potatoes?
4. How much equipment do you need to have a successful potato project?
5. What kind of soil is best for potatoes?
6. Is a badly eroded field likely to produce a good crop?
7. Why is sod land likely to be a poor place to grow potatoes?
8. What is the best rotation for potatoes?

9. What is pH?
10. What pH or soil acidity value is best for potato growing? Why?

Choice of Variety

The new disease-resistant potato varieties are likely to replace the old ones. Some of these new varieties are resistant to late blight, scab, and leafroll. A variety that is immune to a disease will not get the disease under any condition. Plant breeders are trying to develop immune varieties, but do not have them yet. A variety that is resistant may not get the disease under ordinary conditions; but, if it does, it will less affected than will an ordinary variety. A variety that is susceptible is likely to get the disease readily under usual conditions.

Choose a variety that has done well in your locality or which seems to meet most of your needs. No variety, of course, is best for all purposes or all conditions of soil and climate. Of the older varieties, Katahdin does well under more different conditions than does any other. Refer to the descriptive table of varieties on page 27.

Questions

The leader may ask these questions while the club members are studying the table.

1. Name at least 3 varieties that are resistant to late blight.
2. Is any variety best for all purposes and all conditions?
3. Name a variety that is resistant to scab.
4. What does *susceptible* mean?
5. What does *immune* mean?
6. What does *resistant* mean?
7. Name 3 early varieties.
8. Name 5 varieties that have white blossoms.
9. Name a variety that grows very large and erect.
10. Name 9 varieties that cook mealy.

Buying and Handling Seed

Disease-free seed is important. Growing certified seed is mostly a matter of growing seed that is free from diseases that are carried inside the tubers. Leafroll, mosaic, and other virus diseases are carried in the seed and usually the only way to tell them is in the growing plant. They dwarf the plant and cut the yield to one-half or two-thirds of normal. Fields that are planted with seed that is free from those yield-reducing virus diseases are likely to pay best for the fertilizer, spray, and care you give them. Like the virus diseases, bacterial ring rot is also carried in the seed, but it can usually be seen in the tuber. To prevent these diseases, get certified seed or other seed known to be free or nearly free from them.

Seed of good quality may be selected by anyone who can tell healthy plants from those that have virus diseases, black leg or bacterial ring rot. It is necessary to go over the field every week or ten days to pull out diseased plants. Only seed from the disease-free hills which remain should be saved.

Seed plots should be kept thoroughly sprayed or dusted with DDT, as certain insects carry some of the diseases from one plant to another.

The effect of the quality of the seed planted is shown in table 1. Part of the increase in yield might have been due to better care of the crop grown from certified seed.

Table 1. **Potato yield as influenced by quality of seed potatoes**

(Results from 258 4-H potato projects in seven New York counties in 1934)

Quality of seed	Projects reported	Yield per acre
	Number	*Bushel*
Certified seed or seed grown from certified seed the year before	169	201
Common seed	89	157

Keeping Seed Potatoes over Winter

All varieties of potatoes will come up quickest and usually will produce the largest yields if they have some sprouts at planting time. To start sprouts, keep the potatoes at temperatures above 45° F. for three or four weeks before planting. Keep the seed in a light place so the sprouts will become green and tough and will be less likely to break off while being planted. Do not take off the sprouts before planting unless they are so long (an inch or more) that they are likely to break off when you plant them. Long sprouts may be broken off a week or two before planting if the potatoes are then kept where the temperature is 60° F. or above so that new sprouts will develop quickly.

Cutting, Curing, and Rate of Planting

Large potatoes should be cut for seed but small potatoes may be planted whole. Small, whole tubers are fully as good as cut pieces of large tubers if you select them from disease-free stock and they may be better as no cut surfaces are exposed to drying or decay. The actual cutting of a tuber makes it neither better nor worse under normal conditions, but freshly cut seed planted in very dry soil or in wet, cold soil is likely to result in a poor stand. The most serious spread of bacterial ring rot is from the cutting knife. Planting small tubers whole prevents this danger.

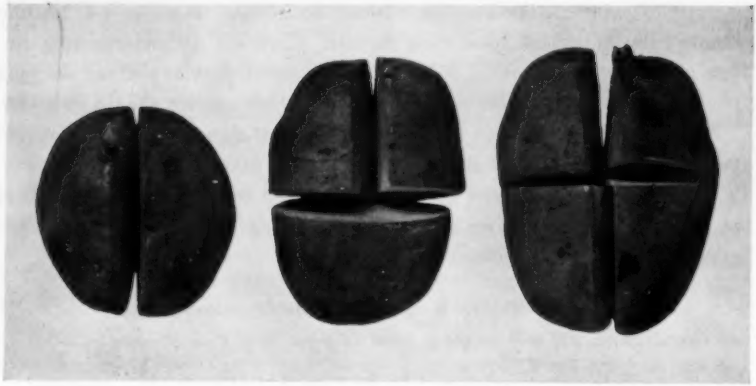

Figure 4. This is the way to cut potatoes for seed. From left to right, the tubers weigh: 3, 4½, and 6 ounces; weight of each seed piece is 1½ ounces

Cut seed, if cured before planting will usually produce good stands. To cure, keep the cut seed where the air is relatively warm and moist. The best temperature for rapid curing is from 55° to 75° F. A higher temperature is likely to cause rot. Do not store cut seed in a cold cellar. It is best to cut potatoes two or three days before planting, and there is likely to be no harm if you cut them two or three weeks in advance and cure and store them as suggested.

One eye on each seed piece is enough if it has a healthy sprout. Seed pieces should weigh approximately 1½ ounces—10 or 11 pieces to the pound. Pieces much smaller than this do not contain enough food to give the young plant a vigorous start; they may not have one good eye, and are likely to shrivel. Pieces much larger than 1½ ounces make the cost of seed high.

Suggestions on how to cut 3-, 4½- and 6-ounce tubers are illustrated in figure 4. The eyes at the bud end always should be divided. Square cuts make blocky pieces with the least cut surface and are easily made.

The amount of seed needed to plant an acre at different spacings and with different sizes of seed pieces is shown in table 2. Experience shows that it is best to plant 1500 pounds (25 bushels) or more of seed to the acre.

Seed Treatment

Chemical treatment is not recommended under all conditions. It is best to plant seed that is as near free from disease as possible. Sometimes, however, it is necessary to use seed that has a small amount of disease. If seed

is known or thought to have any bacterial ring rot, stand the cutting knives in a glass of corrosive sublimate (1 to 1000). Be sure to have 2 or 3 knives and change knives every 5 or 6 potatoes or after cutting a rotten one.

***Table 2.* How much seed to buy or save to plant an acre**

Distance between rows	Distance between seed pieces in the row	Amount of seed required to the acre if each seed piece weighs			
		1 ounce	1¼ ounces	1½ ounces	1¾ ounces
Inches	*Inches*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
30	6	2,178	2,722	2,800	3,812
	8	1,633	2,042	2,450	2,859
	10	1,307	1,633	1,960	2,287
	12	1,089	1,361	1,633	1,906
32	6	2,040	2,552	3,060	3,576
	8	1,530	1,914	2,298	2,682
	10	1,225	1,530	1,836	2,142
	12	1,020	1,276	1,530	1,788
34	6	1,920	2,400	2,880	3,360
	8	1,440	1,800	2,160	2,520
	10	1,152	1,440	1,728	2,018
	12	960	1,200	1,440	1,680
36	6	1,816	2,268	2,724	3,176
	8	1,362	1,702	2,040	2,382
	10	1,090	1,362	1,632	1,906
	12	908	1,134	1,362	1,588

Table 3.* Relation of plant spacing to yield

(Results from 258 4-H potato projects in seven New York counties in 1934)

Average distance between plants in the row at harvestime	Projects in survey	Yield per acre
Inches	*Number*	*Bushels*
14	33	259
17	48	185
21	92	180
26	54	169
36	31	159

* Many growers are now planting seed pieces only 6 inches apart in the row.

Questions

1. What diseases can be identified only in the growing plant?
2. What effect does leafroll have on the yield of a potato plant?
3. Who had the highest yield of potatoes in 1934 (table 1)—4-H members

Figure 5. This is a good stand. These Russet Rurals were planted from 10 to 11 inches apart in 34-inch rows and produced 300 bushels to the acre in 1935 when the New York State average was only 110 bushels to the acre. Now the State average yield is 250 bushels to the acre and good growers get 500 bushels or more

who used certified seed or those who used common seed? What was the difference in yield?

4. How do certified-seed growers get rid of virus diseases in potatoes?
5. How is DDT helpful in certified-seed production?
6. How can seed potatoes be made to develop short, tough, green sprouts?
7. Which is best for seed, a whole small potato or a cut piece of a large one?
8. At what temperature should seed potatoes be stored for the last month before planting?
9. What size seed pieces are best?
10. How many bushels of seed to the acre are best?

Plowing and Fitting

Potatoes need the soil loosened to a depth of 6 or 8 inches. The easiest way to do this is with a plow. Discing alone is not enough. Deep tilling with a tractor drawbar-mounted tiller, or with a heavy tractor-weed-hog-type spring-tooth harrow may be enough on some soils.

Fitting loosens the soil, levels the surface, and kills any weeds that have started. Early plowed land that is planted late should be harrowed often enough to kill all weeds while they are small and deep enough to keep the soil loose for 4 or 5 inches down.

Fertilization

The nutrient elements commonly needed in the average soil are nitrogen, phosphorus, and potash, and are always given in that order in fertilizer analyses; for example, 100 pounds of 8–16–16 fertilizer contains 8 pounds of nitrogen, 16 pounds of phosphoric acid, and 16 pounds of potash. Enough of the other chemical elements needed by plants are present in the soil or enough are supplied in the fertilizer as impurities or by the addition of small amounts of chemicals.

To produce a good crop of potatoes, most upstate New York soils seem to need at least 100 pounds of nitrogen, 200 pounds of phosphoric acid, and from 200 to 300 pounds of potash. The best way to get these nutrients is from 1250 pounds of an 8–16–16 fertilizer. On Long Island, half as much potash seems to be enough. The analysis figures given on the bag are the pounds of each nutrient in 100 pounds of fertilizer.

If you use less than 1000 pounds of commercial fertilizer to the acre, it is best to place it in bands along both sides of the row, as deep as the seed pieces and 2 or 3 inches away from them. You can do this easily with a modern fertilizer distributor on a potato planter, but is not practical for hand planting. With hand planting, drop small handfuls of fertilizer between the seed pieces in the row and take care that no fertilizer touches the seed pieces. If you use fertilizer at the rate of 1500 to 2000 pounds or more to the acre, usually the results are best to broadcast one-half before plowing, or distribute it with a fertilizer attachment on the plow, and apply the other half in bands along the row or between the seed pieces.

Manure may be used satisfactorily where scab is not a problem. Ten tons of manure and 1000 pounds of commercial fertilizer to the acre are likely to give good results. Fresh manure is more likely to encourage scab than is well-rotted manure. If you must use fresh manure, it is least likely to increase scab if you put it on during the fall or early winter.

Questions

1. What do each of the figures stand for in a fertilizer analysis such as a 5–10–10?
2. How many pounds of nitrogen, phosphoric acid, and potash are needed to produce a large crop of potatoes?
3. How many pounds of 5–10–10 per acre is needed to give these amounts of fertilizer nutrients?
4. If manure is used, how much commercial fertilizer is needed?
5. Is fresh manure likely to cause any trouble? What?
6. Is it best to broadcast and plow under part of the fertilizer?

7. How should the balance be put on?
8. Should fertilizer touch the seed pieces?
9. How much 5–10–10 fertilizer contains the same amount of nutrients as a ton of 8–16–16?
10. How much 10–20–20 equals 1 ton of 8–16–16?

Planting

Figure 6. A 2-row picker-planter. You need a 2-row planter if you are going to use a 2-row cultivator

Wait to fit the ground and to plant the seed until the ground is dry enough to work without packing. You may plant the early crop as soon as the ground is dry enough to work, but many potato growers have found that early and midseason varieties yield best if planted by late May or early June in most parts of upstate New York. Late planting makes it possible to kill many more weeds before planting by harrowing the entire field once a week.

Deep planting followed by relatively level culture is likey to produce the best results under most New York State conditions. Some ridging, however, makes digging easier and results in fewer misshapen tubers.

Cultivation and Weed Control

With usual weather conditions, many weeds are likely to appear about a week or ten days after the potatoes are planted. At this time the potatoes will not have come up and a single trip over the field with a weeder or a spike tooth harrow, or one application of a contact weed-killing spray, kills nearly all of these small weeds, both between the rows and in the row. Be sure to get complete instructions on how to use the spray before you try it.

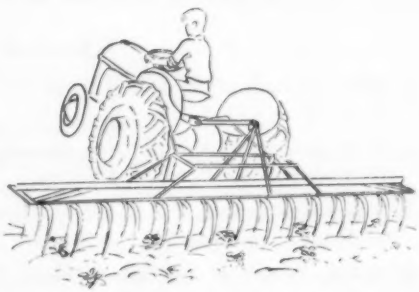

Figure 7. A tractor-mounted weeder is thorough and efficient

Record 12 Reprinted September 1954

4-H Potato Record

ARTHUR J. PRATT

Name..... Age.....

P. O. Address.....

Township..... County.....

Local Leader..... Name of club.....

This year is my ..... year in club work.

Variety of potatoes grown.....

Date planted..... Bushels planted.....

Length of field (*feet*)..... Width (*feet*)..... Area (*square feet*).....
length × width = area

Acres (or part of an acre)..... (*area in square feet ÷ 43,560 square feet per acre = area in acres*)

Everyone must fill in the part above and that on page 4.

The center pages and the spaces below should be filled in for your own information and if you wish to compete for State and National awards. If you wish, you may get a complete cost-account crop record book from your 4-H Agent.

Copy in the columns below the total *expenses* and *returns* given in the detailed labor and financial records on pages 2 and 3.

Expenses		**Returns**	
Rent of land ... $		Value of all potatoes sold ... $	
Seed (total value) $		Value of all potatoes used and on hand ..... $	
Fertilizer (total value) . $		Total value of crop (returns) $	
Dust or spray ... $			
Human labor (all but yours) $			
Tractor use ..... $			
Horse labor ..... $			
Other expenses . $			
Total $			

$..... − $..... = $.....
Returns *Expenses* *Net gain*

$..... ÷ .....hours = $.....
Net gain *Your labor* *Your hourly wage returns*

Cornell 4-H Club Project Record

LABOR RECORD

Keep a day-to-day record on the calendar, or in a diary, or write it on this blank in small figures. Add these together at the end of the season, and put the totals in the blanks on pages 2 and 3.

Any jobs that you hired done by the acre should be entered only on page 3.

	Your Labor	Other Unpaid Labor			Paid Labor		
	Hours	Hours	Rate	Total Value	Hours	Rate	Total Paid
Plowing			$	$		$	$
Harrowing							
Fertilizing							
Cutting seed							
Planting							
Weeding: Mechanical							
Hand							
Hoeing							
Cultivating							
Spraying							
Dusting							
Roguing							
Digging							
Picking							
Grading							
Storing							
Selling							
Other							
Total			xxxxxx	$		xxxxxx	$

DETAILED FINANCIAL RECORD

Expenses

Item	Amount	Cost or Value per Unit	Total Cost or Value
Rent of land (if you did not pay any cash rent, figure it at 7 per cent of the value of the land)		$	$
Seed:			
Saved from last year			
Purchased:			
Certified			
Not certified			
Total for seed		xxxxxxxxx	
Fertilizer:			
Commercial			
Give analysis			
Manure			
Total for fertilizer	xxxxxx	xxxxxxxxxxx	
Dust or spray, or custom spraying			
Kind			
Total for spray or dust	xxxxxx	xxxxxxxxxxx	
Tractor use at $1.00 an hour (for entire season)			
Horse labor at $1.00 an hour for a team (for entire season)			
Other expenses (list each one)*			

* Include *machinery use* at 25 cents an hour for each $100 that the machine cost when new; *truck use* at $1.00 an hour per ton capacity; *cover crops* at from $5 to $7 an acre; *irrigation* at from $5 to $6 each time; and *any other expense* connected with growing, marketing, or storing the crop.

Returns†

Item	Amount	Value per Unit	Value
	Bushels		
U. S. No. 1 potatoes sold		$	$
Cull and other potatoes sold			
Total sold		xxxxxxxxxxx	$
U. S. No. 1 potatoes on hand			
Cull and other potatoes on hand			
Potatoes used			
Total used and on hand		xxxxxxxxxxx	$

† If this record is turned in before all potatoes are dug, dig a few and estimate the total yield, and grade a few to get an estimate of U. S. No. 1 grade on hand.

MY POTATO RECORD FOR.....(*year*)

Put a check mark (√) before each job you did

..... 1. Used certified or near-certified seed.
..... 2. Learned to identify virus diseases (leaf roll, mosaic, and others).
..... 3. Rogued all diseased plants in part or all of my field to have high-quality seed for next year.
..... 4. Stored the seed properly to prevent growth of long weak sprouts.
..... 5. Stored the seed at least two weeks before planting at about 50° F. to get it in sprouting condition. This needs to be done only if the seed has no sprouts.
..... 6. Green-sprouted the seed to produce short, strong sprouts.
..... 7. Cut seed into blocky pieces that weighed 1½ to 2 ounces.
..... 8. Cured the cut seed as recommended in 4-H Club Bulletin 80.
..... 9. Had a soil acidity test made. The pH was.....
.....10. Planted on light, well-drained, loamy soil.
.....11. Planted potatoes where potatoes were grown last year.
.....12. Planted potatoes where some other cultivated crop was grown last year.
.....13. Plowed potato field before May 10.
.....14. Fitted the soil when it was not too wet.
.....15. Planted as early as possible.
.....16. Planted rows on the contour (if the field had a slope of 4 per cent or more).
.....17. Used 2000 pounds of a 5–10–10 or similar fertilizer per acre (5 pounds per 100 square feet).
.....18. Spaced seed pieces closely (distance recommended by 4-H agent).
.....19. Used a steel-toothed weeder at least twice over the entire field.
.....20. Cultivated enough to control weeds, and cultivated shallow.
.....21. Had a field demonstration in cooperation with my local leader or 4-H agent.
.....22. Dusted or sprayed the plants to control diseases and insects.
.....23. Dug my potatoes with a tractor and power-take-off digger.
.....24. Learned to pick up potatoes with the least possible mechanical injury.
.....25. Sowed a rye cover crop just as soon as the potatoes were dug; or if potatoes were dug after October 1, sowed rye between rows about September 1.
.....26. Exhibited potatoes at a county or a local show.
.....27. Exhibited potatoes at the State show.
.....28. Gave a demonstration on a topic concerning potatoes.
.....29. Took part in a potato- or vegetable-judging contest.
.....30. Put up some market packages of U. S. No. 1 grade or better for sale.
.....31. Learned to identify at least 4 insects that attack potatoes.
.....32. Learned to identify at least 3 potato diseases.
.....33. Learned to identify at least 15 grade defects.
.....34. Learned how to sort potatoes to U. S. No. 1 grade.
.....35. Learned the names of 10 weeds found in the potato field.

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M. C. Bond, Director of Extension

This record is published and distributed in furtherance of the purposes provided for in the Acts of Congress of May 8 and June 30, 1914

If you use the weeder or harrow, use it two or three times at intervals of a week or ten days until the plants are from 6 or 8 inches tall.

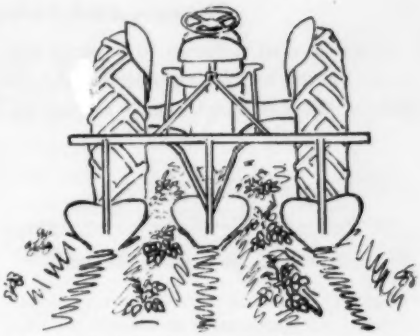


Figure 8. A tractor-mounted hiller — do not set it too deep

Under ordinary conditions two or three cultivations between the rows, besides the early season weedings, kill most of the seeds. Hilling helps to control weeds, to reduce sunburn, and to give smoother potatoes. Also, hilling makes digging easier. Remember that high ridging, done late, may injure the potato roots and dry the soil. Hilling is best done early in the season.

On a small area, a straw mulch may be used in place of cultivation. Plant the potatoes as usual and apply the mulch after you have gone over the field with the weeder or harrow. Approximately 4 inches of loose straw or enough leaves or other mulching materials to cover the ground completely is needed to control all weeds. Spreading mulch requires much labor, but no later cultivations are needed and usually yields are considerably larger on well-drained soil, especially in dry years. Mulching may, however, reduce the yield on a poorly drained soil in a wet year. If you dig the crop by machine, you will have to remove the mulch first.

Questions

1. Which usually comes up first, weeds or potatoes?
2. Can any weeds be killed before the potatoes come up? With what?
3. Can a weeder be used after the potatoes come up?
4. How many cultivations are necessary?
5. Is there any relation between the depth of planting potatoes and the height of hilling? What?
6. Should hilling be done early in the season or after the plants are full-grown?
7. Should hilling be done so as to make high, narrow ridges or broad, flat ones?
8. How can you prevent sunburned tubers?
9. Which conserves moisture better, cultivation or a straw mulch?
10. Could you use a straw mulch in your potato growing program?

Disease and Insect Control

Spray or dust potatoes to prevent late blight, to kill leafhoppers which cause tipburn, to kill flea beetles which eat small, round holes in the leaves, and to kill Colorado potato beetles which eat off big areas of leaves. Sometimes aphids and tarnished plant bugs are also a problem. Although spray or dust tends to prevent damage from these insects and diseases, it does not cure the plants once they have been attacked. The time for action is before the damage is done, not after.

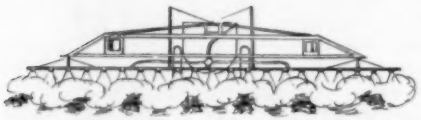


Figure 9. This modern power-sprayer mounted on a tractor pulls easier and injures the vines less than does a trailer sprayer

To control blight, spray or dust potatoes every week or ten days. This keeps the new growth covered and gives extra covering to the old growth. Begin spraying or dusting as soon as the plants come up. For the blight-susceptible varieties, use a fixed copper and DDT dust which can be bought ready mixed or use a bordeaux spray plus 1 quart of 25 or 30 per cent liquid DDT to 100 gallons of spray or the bordeaux spray plus 2 pounds of 50 per cent DDT wettable powder to 100 gallons of spray. Make the bordeaux spray by dissolving 10 pounds of fine copper sulfate in 100 gallons of water and mixing in 5 pounds of spray lime. Add the DDT last.

You may substitute carbamate spray for the bordeaux mixture and use it at manufacturer's directions, but it must be applied every five days to control late blight when the weather is favorable (cold and damp) for the spread of that disease.

A modern power sprayer should have three nozzles to the row and maintain at least 250 pounds of pressure. Adjust the nozzles so the spray strikes the vines with some force and so all parts of the vines are covered. At least 125 gallons of spray is needed to cover thoroughly an acre of full-grown potato tops.

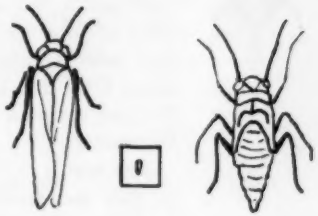
If you use a hand sprayer, apply as much pressure as possible. Cover all leaves.

Dust can be applied more effectively by hand than can spray. Apply copper-lime dust only when the vines are wet and the air is quiet. This usually means at night or during the early morning. DDT dust alone or DDT plus fixed copper may be applied whether the plants are wet or dry so long as the air is *quiet*. From 25 to 40 pounds of dust is needed for an acre of full-grown potato tops.

Some Common Insects

Potato Leafhoppers

Potato leafhoppers are slender green insects about 1/10 inch long and are usually found on the underside of leaves. When disturbed they move sideways or spring into the air for a short flight and disappear under another leaf. The injury they cause, hopperburn, first appears as a slight yellowing of the tip of the leaf. The edge of the leaf then turns brown, curls upward, and dries out. Sometimes all the foliage is destroyed and the plants are killed. Spray or dust with DDT to control leafhoppers (page 16).



Enlarged *Natural size* *Nymph*

Leafhoppers

Potato Flea Beetles

Flea beetles are black insects about 1/16 inch long. They eat small round holes in the leaves. DDT controls them easily (page 16).

Enlarged *Natural size*

Flea beetle

Colorado Potato Beetles

Adult potato beetles pass the winter in the ground and come out just before early planted potatoes come through the ground. After eating potato leaves for a few days, the female beetle begins to lay her orange-colored eggs on end in clusters on the underside of the leaves. The eggs hatch in from four to nine days and the young larvae begin to eat potato leaves at once. It is in this stage that the most serious damage is done. The larvae become full-grown in ten days to three weeks and after a pupal period of from five to ten days appear as adults again. The second brood is seldom serious. Both the adults and larvae are usually controlled with DDT (page 16). If they have become resistant to DDT in your area, ask your 4-H club agent for recommendations.

Enlarged *Larva* *Natural size*

Colorado potato beetle

Tarnished Plant Bugs

Tarnished plant bugs are very active, brownish in color and about ¼ inch long. They cause the growing tips of potato vines to wilt, droop, and turn gray. They are easy to control with DDT (page 16).

Enlarged *Natural size*

Tarnished plant bug

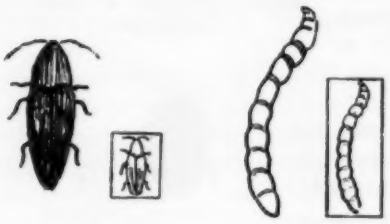
Enlarged (top)
Natural (bottom)
Aphid

Aphids

Aphids, or plant lice, may be winged or wingless. Usually they are green or pink in color and about the same size as leafhoppers, but are much less streamlined in appearance. They are not likely to become a serious problem on potatoes that have regular applications of DDT, especially if the liquid DDT has been used. Parathion controls aphids where they are a serious problem.

Wireworms

The wheat wireworm adult, or click beetle, lays its eggs in May and June in soil that is heavily covered with grass, weeds, or winter grain so that the ground is kept shaded and moist. The young wireworms become partly grown the first summer. The second summer they feed the most rapidly and cause the greatest injury, making small, round holes that often go deep into the tubers. By the second fall the wireworms are nearly full-grown and remain over winter in that condition to complete their growth and transform to pupae during July of the third summer. The pupae transform into beetles in a few weeks, but the beetles do not come out of the ground until the fourth spring.



Adult *Natural size* *Larva* *Natural size*

Wireworm

Wireworms can be controlled if chlordane or heptachlor is applied to the soil just before planting and worked in to a depth of from 3 to 5 inches. Use chlordane at the rate of 5 or 6 pounds, or heptachlor at 2 pounds, of the actual material per acre.

June Beetles

June beetles lay the eggs that hatch into white grubs. They lay their eggs at about the same time of the year and under the same conditions as do the click beetles, and the young white grubs take just about as long to grow up as do the young wireworms. White grubs damage the potato tubers by eating large holes that look much like rat injury. White-grub injury is more serious some years than others, and is most serious where potatoes are planted on ground that was in an old grass sod last year. Control is the same as for wireworms.

Adult *Larva*

June beetle

Questions

1. How many insects are serious potato pests?
2. What does the adult of the white grub look like?
3. What does the adult of the wireworm look like?
4. What kind of damage is caused by leafhoppers?
5. How are leafhoppers controlled?
6. How are wireworms controlled?
7. How is blight controlled?
8. How may aphids be controlled when they have become a serious problem?
9. How much dust is needed to dust an acre of potatoes?
10. How many gallons of spray is needed to cover thoroughly an acre of potatoes when the tops are full-grown?

Harvesting

Do not dig potatoes before the plants are dead except for an early market when the price is likely to be higher than it will be later in the season. Even then you should use a vine-killing spray or flame gun to kill the vines, to get them out of the way of digging and picking, and to reduce the possibility of damage from blight rot following digging. Harvesting before maturity means a considerable loss in yield, because tubers increase in size rapidly during the last stages of their growth.

When blight is general throughout the field, it is a mistake to harvest the crop with the idea that rot can be prevented or reduced. Harvesting at this stage is almost certain to increase rot, and you will have rotten potatoes in the storage instead of in the field. Under these conditions, vine killing is almost certain to pay big dividends.

Mature potatoes are less likely to be injured by handling than are immature ones. Immature tubers shrink more in storage because they have a higher water content and skin and bruise easier in handling than do mature tubers. Always wait a week or more after the tops are killed, before you dig the potatoes.

Bruised and air-cracked tubers are the result of careless handling. Check the cause to see whether it is careless digging or careless picking and handling. If many tubers show bruises before picking, run the

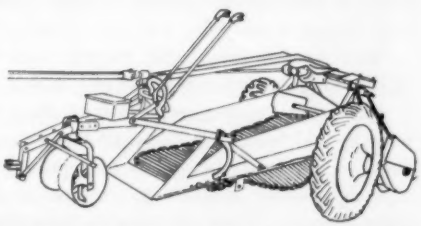


Figure 10. A power-take-off digger like this one causes less bruising than does a traction digger

digger slower or set it deeper. Injury from picking is less if you use splint or rubber-covered wire baskets rather than crates. Potatoes should be handled almost as carefully as eggs would be handled.

Questions

1. Should potatoes be dug before the tops are completely dead? Explain.
2. Should blighted potatoes be dug quickly or left until the tops are completely dead?
3. Would killing the vines with a spray or a flame gun be likely to reduce rot following blight?
4. With the same care in handling, do mature or immature tubers bruise most? Explain.
5. How long should you wait after potato tops are killed before you dig the tubers?
6. Are crates better than baskets or pails for picking potatoes? Why?
7. Potatoes in a bin show bad bruises and air cracks. What caused this?
8. If the digger is set deeper will the amount of bruising be more or less?
9. If the digger is run slower will the amount of bruising be more or less?
10. Does a mature tuber or an immature tuber have a tougher skin?

Cover Crops

Rye is the most satisfactory cover crop to plant in the fall after the potatoes are dug. It makes the most growth during late fall and early spring before plowing. It is not a legume and hence adds no nitrogen to the soil, but it does take up and conserve much of the available nitrogen that might otherwise be lost by leaching during late fall and early spring. It is an excellent crop to hold the soil against erosion. Rye should be seeded at the rate of 2 bushels to the acre. You may either drill or broadcast the seed and then harrow it in immediately after you dig the potato crop, or you may broadcast the rye seed between the rows of late potatoes about September 1.

Perhaps millet, either Japanese or German variety, is the most common summer green-manure crop. It should be seeded at the rate of 1 peck to the acre.

Buckwheat makes rapid growth and is good for loosening hard soils. It should be seeded at the rate of 1 bushel to the acre.

Any other rapid-growing annual may be planted for this purpose. The crop should be disced down or plowed under before any seeds mature, for they are likely to become weeds in the potato field the following spring.

Seed another crop of rye as soon as the summer green-manure crop is turned under. Good farming dictates that the ground never be left bare over winter and never longer than is necessary during the growing season.

Questions

1. What is the best cover crop?
2. Does rye add nitrogen to the soil?
3. Does rye save nitrogen?
4. What cover crop is best to prevent erosion of the potato field during winter?
5. Name 2 good summer green-manure crops.
6. When should summer green-manure crops be disced down or plowed under?
7. After a summer green-manure crop is plowed under, should the ground be left bare until the following spring? If not, what should be done?
8. How much rye is needed to seed an acre?
9. How much buckwheat is needed to seed an acre?
10. How much millet is needed to seed an acre?

Exhibits

Potatoes for exhibit should be selected at digging time. Save several times as many as will be needed for the exhibit. Keep them away from rats, and store them under such temperature and humidity conditions that they will not sprout or shrivel. Refer to storage (page 23). Just before the time for the exhibit, make the final selection from these potatoes.

Potatoes for exhibit should be clean. They may be cleaned either by washing or brushing with a soft brush. Whatever the method, take care not to injure the skin. Select exhibits to come as near as possible to the *Excellent* standards given in the score card.

The following score card is widely used in judging potato and other vegetable exhibits. Numerical values are not used in the score card because any one of these points may be so bad that it out-weighs all of the others combined. Assigning numerical values to a score card makes a clerk out of the judge and, to a considerable extent, prevents him from using his judgment.

Single-plate exhibits usually consist of 5 tubers. Larger exhibits may consist of 15, 20, or 32 tubers. Market-package exhibits may be 5, 10, 15, 50, or 100 pounds. Study premium lists and follow all suggestions carefully when preparing an exhibit. To exhibit either 6 tubers or 4 when the premium list asks for 5 is just as bad as mixing two different varieties. All that a judge can do fairly with an exhibit containing the wrong number of specimens is to disqualify it entirely.

Wrap each potato separately in a paper napkin or a piece of newspaper, and pack the wrapped potatoes in a box with more pieces of crumpled paper. Pack very tightly in the box potatoes that are to be shipped by mail or express, to prevent bruising. In cold weather, mark the package "freezable."

Score Card

Excellent	Good	Worthy	Unworthy
Clean	Clean	Fairly clean	Dirty
Free from injury (not more than 2 per cent waste and not more than slightly affecting the appearance)	Free from damage (not more than 5 per cent waste and not distinctly damaging appearance)	Free from serious damage (not more than 10 per cent waste and not seriously damaging appearance)	Seriously damaged by disease, insects, mechanical, or other means
Uniform in size, shape, and color (not more than 10 per cent variation)	Fairly uniform in size, shape, and color (not more than 25 per cent variation	Fairly uniform in size, shape, and color (less than 100 per cent variation)	Extreme difference in size, shape, or color. Plate unworthy if largest specimen is twice the size of the smallest on that plate
Of the best market size and quality; potatoes from 6 to 10 ounces	Of good market size and quality; potatoes more than 5 and less than 12 ounces	Of fair market size and quality; potatoes more than 4 and less than 14 ounces	Below or above size limits for worthy
True to variety type	Fairly true to variety type	Not off-type enough to be disqualified for lack of uniformity	One or a combination of the above points may make an exhibit unworthy

Questions

1. Name 5 points that are necessary for an *excellent* exhibit.
2. When is the time to select potatoes for a winter exhibit?
3. Assume that a winter exhibit class calls for 20 tubers. How many potatoes should be selected at digging time to be sure that you have enough?
4. What sized potatoes are best for show?
5. How should potatoes be cleaned?
6. How many potatoes are usually shown in single-plate exhibits?
7. How should potatoes be wrapped to carry or ship them to the exhibit place?
8. Will potatoes shipped for exhibit be bruised the least if packed tightly or loosely in the box?
9. According to the score card, how would you place a plate of 5 clean potatoes that were free from injury, uniform in size, shape, and color, true to variety type, and weighed 16 ounces each?

10. How should a plate be scored that has 5 uniform potatoes weighing 8 ounces each, that are free from injury, true to variety type, and very dirty?

Judging Contests

Modern judging contests like modern exhibits use the merit, or group-award, system. Classes of 11 exhibits have become standard, as there then cannot be the same number of exhibits in every group and the work of grading the papers is relatively easy. Any number of exhibits, however, may be used and it is often desirable at fairs to let the contestants judge some selected classes of competitive exhibits, rather than to set up separate classes for a contest. The plates are lettered from A to K, inclusive, and the contestants are given judging blanks similar to the one illustrated (figure 11). With a total score of 100 points for 3 or 4 classes, 1 point is usually deducted for each place that a contestant puts the exhibit away from where it should be. For example, in the Chenango class in the score card, where the check marks (√) are the contestant's placings and the punched holes are the correct placings, plate A was placed 1 class too high, therefore 1 point is deducted; plate B is correct and there is no deduction; Plate C is 3 classes away and 3 points are deducted; and so on. If there is an omission or a double entry, 3 points are deducted. See Katahdin class. If only a single class is judged, 3 times as much is deducted for each mistake.

If printed or carefully mimeographed judging contest blanks are used, from 10 to 20 completed contest blanks may be stacked in a heap with the check sheet on top and corrected merely by driving a nail down through the entire stack in the correct squares. The deductions are then made on the individual contest blanks.

Storage

Potatoes keep best in a dark place where the air is fairly moist. The moisture content of the air is called the *relative humidity* and should be 90 per cent or more. The temperature is best between 36° and 42° F. The actual freezing temperature of potatoes is about 29° F.; at from 29° to 36° F. the tubers may become sweet and will not keep any better than at the slightly higher temperatures. Potatoes soon sprout if stored long at temperatures above 42° F. unless treated with chemicals to prevent sprouting. Potatoes for storage should not be dug until the vines are completely dead and the tubers mature enough so that they are not easily skinned. Cut or skinned surfaces heal over most rapidly if the potatoes are stored at 50° to 70° F. for a week or two after digging and then kept below 42° F. unless treated. Potatoes kept at the temperatures suggested keep well directly on a

CROP JUDGING CONTEST

Name Jim Jones Address Friendship

County Allegany Date March 29, 1947

Check the square ☐ where you think each plate should be placed.

Deductions

1 place = 1 point
2 places = 2 points
3 places = 3 points
2 checks on line = 3 points
Omission — 3 points

Perfect Score = 100
Deductions = 24
Net Score = 76

KIND OF VEGETABLE: Cleanage

Plate	Excellent	Good	Worthy	Unworthy	Points Off
A	✓	○			1
B			○		
C	✓			○	3
D		○			
E		○	✓		1
F		○		✓	2
G		○			
H				○	
I			○		
J			✓	○	1
K	✓	○			1
				Total	9

KIND OF VEGETABLE: Katahdin

Plate	Excellent	Good	Worthy	Unworthy	Points Off
A				○	
B			○		
C		○			
D		○	✓		1
E	✓	○		✓	4
F	○				3
G		○			
H	○	✓			1
I			○		
J	○				
K			○	✓	1
				Total	10

KIND OF VEGETABLE: Sebago

Plate	Excellent	Good	Worthy	Unworthy	Points Off
A			✓	○	1
B		✓	○		1
C	✓	○			1
D				○	
E				○	
F	○				
G			○		
H		✓	○		1
I		○			
J			○	✓	1
K				○	
				Total	5

JUDGING POINTERS

EXCELLENT

CLEAN
FREE FROM INJURY
(Not over 2% waste and not more than slightly affecting the appearance)
UNIFORM IN SIZE, SHAPE AND COLOR — Not over 10% variation
OF THE BEST MARKET SIZE AND QUALITY
Beets—1½ to 3"
Carrots—1 to 2½"
Onions—over 2"
Potatoes—6 to 10 oz.
True to variety type

GOOD

CLEAN
FREE FROM DAMAGE
(Not over 5% waste and not distinctly damaging appearance)
FAIRLY UNIFORM IN SIZE, SHAPE AND COLOR — Not over 25% variation
OF GOOD MARKET SIZE AND QUALITY
Beets—over 1¼ and under 3½"
Carrots—¾ to 2¾"
Onions—over 1¾"
Potatoes—over 5 and under 12 oz.
Fairly true to variety type

WORTHY

FAIRLY CLEAN
FREE FROM SERIOUS DAMAGE
(Not over 10% waste and not seriously damaging appearance)
FAIRLY UNIFORM IN SIZE, SHAPE AND COLOR—Less than 100% variation
OF FAIR MARKET SIZE AND QUALITY
Beets—over 1 and under 4"
Carrots—¾ to 3"
Onions—over 1¼"
Potatoes—over 4 and under 14 oz.
Not off type enough to be disqualified for lack of uniformity

UNWORTHY

DIRTY
SERIOUSLY DAMAGED by disease, insects, mechanical or other means
EXTREME DIFFERENCE IN SIZE, SHAPE AND COLOR — Plate unworthy if largest specimen is twice the size of the smallest on that plate
BELOW OR ABOVE SIZE LIMITS FOR WORTHY
One or a combination of the above points may make an exhibit unworthy

Figure 11. Score card for judging

dirt floor in an ordinary house cellar. Concrete floors or bins with board flooring are not needed except where water might stand if the floor were dirt. Shrinkage is likely to be greater on board floors than on dirt.

Marketing

The first principle of successful marketing is to know the quality of the product you have for sale and then to represent it to the buyer exactly as it is. If you over-praise your goods, you are likely to lose both a customer and a friend, or at least a potential friend. Official grading standards make it possible to sort potatoes so that both the grower and the buyer have common terms to describe the product. The official grade standards may be obtained from the New York State Department of Agriculture and Markets, Albany, New York.

Remove all injured and small potatoes before you sell your crop. There is likely to be a loss in selling field-run potatoes to a dealer. The buyer is going to pay enough less for field-run potatoes so that he can afford to sort them. The poorest potatoes in any container usually set the price for the remainder. Therefore, it is desirable to separate the good and poor so that the price of the entire lot is not set by the poorest tubers.

A reputation for honesty requires that you put just as good potatoes in the bottom of the container as you put on top. The law also requires a uniform pack.

A few club members have successfully marketed a fancy grade of potatoes in 10-pound bags. Such a project is worth attempting only when you have excellent potatoes at the start. This can be determined by carefully sorting a sample to find the grade best suited to the quality of potatoes on hand.

Irrigation

Profits in small-scale potato growing depend on high yields. During some part of almost every season, yields are limited by a lack of rainfall. In hot weather, rapidy growing potatoes use 1½ inches of water in a week. The actual amount used depends on the temperature, on the relative humidity (amount of moisture in the air in relation to the amount that it can hold), and on the wind movement. Most water is used in hot, dry, windy weather.

The afternoon (critical period) temperature varies with the elevation. In July the temperature in downtown Ithaca, at 400 feet elevation, is frequently from 15 to 17 degrees higher from 4 to 6 o'clock in the afternoon than it is 8 miles east on Mt. Pleasant at 1800 feet elevation. Therefore, the need for water would be much greater in downtown Ithaca, but the rainfall in the two places is likely to average approximately the same, tho a local shower may hit either place and not the other.

Water is most efficiently applied by a sprinkler system. Two common types

are (1) the perforated pipe, which waters a rectangular area, and (2) the rotating sprinkler, which waters a circular area.

To put 1 inch of water on an acre requires approximately 28,000 gallons, allowing for some evaporation, or approximately ⅔ gallon for each square foot of area. Thus, a garden hose delivering 3 gallons of water a minute would have to run day and night for 6⅓ days to put on 1 acre inch.

The loss of water from leaves (*transpiration*) is greater than the loss of water from the soil (*evaporation*). Therefore, a crop with large tops needs more water than one just coming up. It is well, however, to keep the soil-moisture content up to a good level early in the season, rather than to allow the plants to become stunted at that time. One inch of water a week, including rain, is probably enough when the plants are small. Later, in hot and dry weather, 1½ inches will be needed.

Give sandy soils no more than 1 inch of water each time, as more is likely to run through the soil taking away some of the fertilizer. Loams and heavier soils may hold as much as 2 inches of water each time, but such heavy applications may be harmful if there should be heavy rains during the next day or two.

Do not put the water on so fast that it runs off, thus wasting water and carrying away some valuable soil. On the other hand, do not put it on so slowly that it keeps the leaves wet longer than necessary which might increase blights. Few soils take more than 1 inch of water in an hour. Most soils take 1 inch of water in 2 hours, unless they have been packed by working when wet. Scatter a small amount of straw, sawdust, or some other litter on the surface to help the soil to take up water faster and to reduce run-off and erosion.

Start irrigating before the soil gets very dry. Anyone who has a large irrigation system should have soil-moisture blocks and a moisture meter. Start the irrigation as soon as the moisture in the soil gets down to 50 to 60 per cent of that which is available to the crop.

Questions

1. Name 4 things that determine the amount of water that a crop needs.
2. What is relative humidity?
3. Is more or less irrigation needed at high elevations?
4. How many gallons of water makes 1 acre inch?
5. Try a faucet or a hose and measure the number of gallons that it will give off in 1 minute.
6. Should sandy soils be given 2 inches of water each time?
7. How can a soil be made to take up water faster?
8. As the temperature goes up, does a plant's needs for water go up or down?
9. Does a strong wind increase or decrease the plant's need for water?
10. How much water will the average soil absorb in 1 hour?

Characteristics of Some Potato Varieties

Variety	Disease resistance			Time of maturity	Tubers				Blossoms	Tops
	Late blight	Scab	Leafroll		Color	Shape	Eyes	Cooking quality		
Cherokee	Resistant	Resistant	Susceptible	Second early	Ivory	Oval flattened	Many	Mealy	White	Small, bushy
Chippewa	Susceptible	Susceptible	Susceptible	Second early	Ivory	Oval flattened	Few, shallow	Soggy, but white	Lilac	Medium, spreading
Cobbler	Susceptible	Susceptible	Susceptible	Second early	Ivory	Cubical	Many, deep	Fairly mealy	Lilac	Medium, spreading
Green Mt.	Susceptible	Susceptible	Susceptible	Midseason	Dull ivory	Oblong	Many	Mealy	White	Large, spreading
Houma	Susceptible	Susceptible	Susceptible	Midseason	Ivory	Oval flattened	Few	Mealy	White	Large, spreading
Katahdin	Susceptible	Susceptible	Resistant	Midseason	Ivory	Deep oval	Few, shallow	Fairly mealy	Lilac	Large, spreading
Kennebec	Resistant	Susceptible	Resistant	Midseason	Ivory	Oblong flattened	Many, shallow	Mealy, white	White	Large, spreading
Ontario	Resistant	Very resistant	Susceptible	Late	Dull ivory	Oblong	Shallow	Soggy	Pale lilac	Large, spreading
Pontiac	Susceptible	Susceptible	Susceptible	Late	Red	Cubical	Many, medium	Soggy	Reddish purple	Large, spreading
Rural*	Susceptible	Susceptible	Susceptible	Late	Dull ivory	Oval flattened	Few, medium	Fairly mealy, dark	Purple	Large, spreading
Sebago	Slightly resistant	Susceptible	Susceptible	Late	Ivory	Oblong	Few, shallow	Fairly mealy, white	Lilac	Very large, spreading
Teton	Susceptible	Susceptible	Susceptible	Late	Ivory	Deep oval	Medium, deep	Fairly mealy	White	Very large, spreading

* The Russet Rural is brown-skinned and may be slightly more resistant to scab than the White or Smooth Rural.

Upper photograph shows the effects of blight. *Lower left,* a healthy plant; *lower right,* the effects of a leafroll